

# The role of AHPCO Technology in reducing allergic rhinitis cases as Air Purifier, Surface Sterilizer and Ice Maker sterilizer

Dr. Nabarun K. Ghosh, PhD<sup>1</sup>, Dr. Constantine K. Saadeh, MD FAAAAI<sup>2</sup>, Dr. Jeff Bennert, PhD CTN<sup>3</sup> and Ms. Griselda Estrada, BS<sup>1</sup>

<sup>1</sup>Life, Earth & Environmental Sciences

West Texas A&M University, Canyon, Texas 79015

<sup>2</sup>Allergy ARTS, Amarillo, TX 79124

<sup>3</sup>Air Oasis, Research and Development, Amarillo, Texas 79118



**Allergy A.R.T.S.**  
Asthma, Rheumatology Treatment Specialists



## Abstract

The aeroallergen data that we collected using a Burkard Spore Trap for 15 years showed a steady increase in aeroallergen concentration in the Texas Panhandle area. The data showed a strong correlation with the allergy and asthma cases that have doubled since 2007. We developed a novel AHPCO or Advanced Hydrated Photocatalytic Oxidation technology to produce filter less air purifiers, surface sterilizer for cell phones and this technology can be used in meat processing facilities and in the ice makers to reduce the chances of contamination.

We assessed the AHPCO Technology for potential uses as air purification unit, surface sterilizer and net reduction of bacteria, fungi during food processing. A fiberglass chamber was built to evaluate the performance and safety of the air purifiers. Blood, Human cell culture and plant cells were exposed to the AO chamber and The UV chambers to compare the exposures. Petriplates, meat, vegetables were placed in the chamber to assess the capacity of sterilization. Images were captured with FITC, TRITC Filters with a BX40 and SZ-CTV Olympus Microscopes and SEM.

A gradual shift in aeroallergen index with the warmer climate and a shift in flowering seasons were noticed that contributed the increased allergy cases. AHPCO and Plasma nanotechnology can be successfully used in making the Air Purifiers, Surface Sterilizer and Ice-Maker Sterilizers.

## Introduction

The ice served in six out of ten of Britain's most popular high street restaurants contains more bacteria than the toilet water, in a recent investigation "The Daily Mail" has found. Scientific tests revealed that ice from many restaurants had higher levels of bacteria than samples of water taken from their lavatory bowls<sup>3</sup>. Dirty ice machine causing contamination via ice cubes is also a major health problem in other countries including the United States<sup>3,4</sup>. To prevent any potential contamination, the interior surfaces of the ice machine must be cleaned and sanitized regularly. This report justifies the demand and use of novel equipment that will sanitize the surface of an ice machine continuously. We evaluated the Bi-Polar<sup>®</sup> unit built by Air Oasis in sanitizing the ice machine surface. The Bi-Polar<sup>®</sup> creates cold plasma discharge which consists of positive and negative ions from water vapor in the air. Positive and negative ions attach to particles and allergens such as dust, smoke, pollen and dander. Particles cluster together to create larger particles and those larger heavy particles drop out of the air and are easily trapped in filters. This unique and novel technology is now being applied to reduce contamination in ice cubes produced by the ice makers by using unique equipment called the Bi-Polar 2400 built by Air Oasis<sup>®</sup>.

## Analyzing the microflora in an ice maker in use

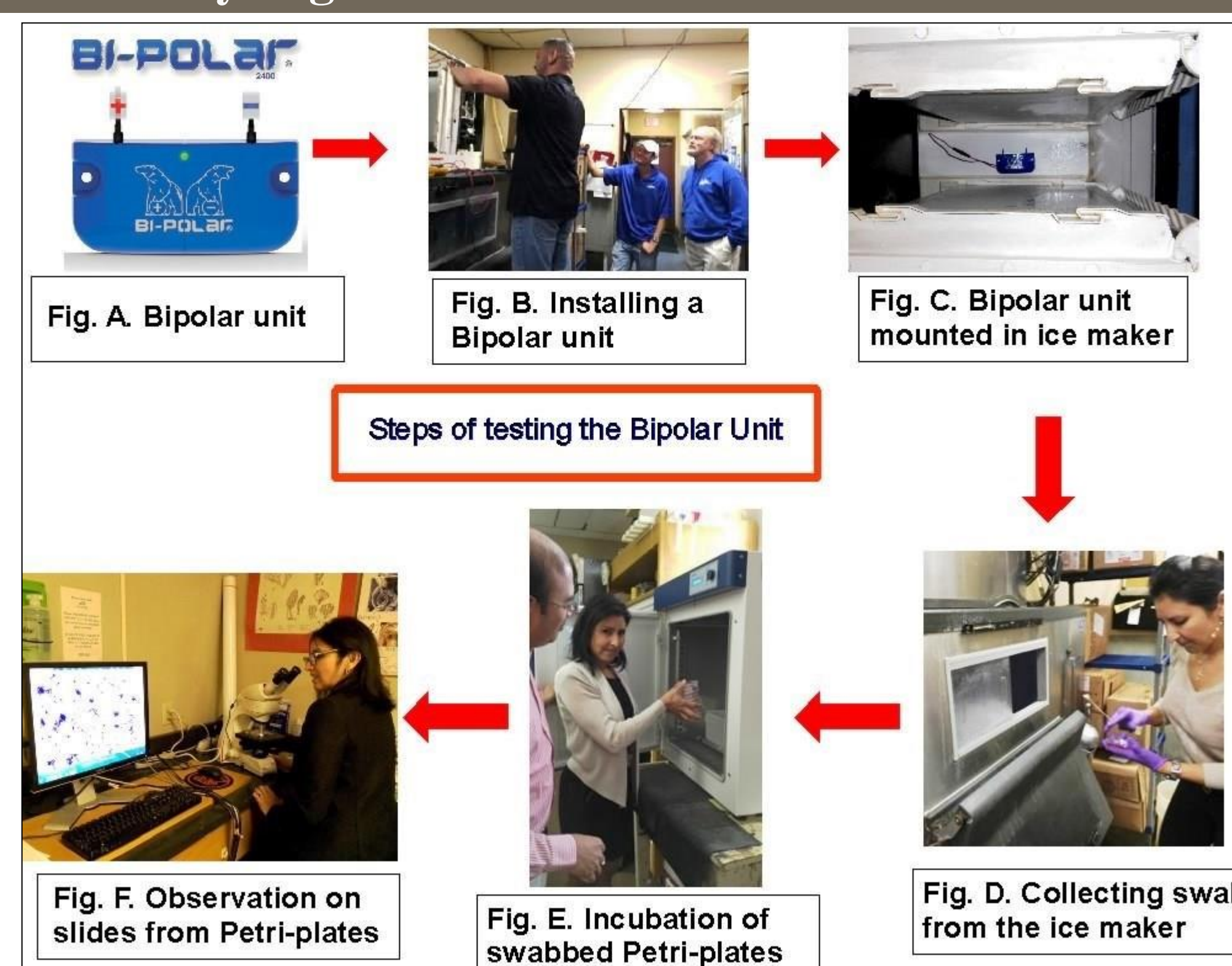


Fig.1. Steps for testing the Bipolar unit.

We used the Brain Heart Infusion Agar Petri plates to standardize the assessment techniques which are often used in food safety, water safety, and antimicrobial susceptibility tests. Petri plates were sealed with Parafilm and stored in a refrigerator. At the end of each experiment the plates were placed in an incubator at 37<sup>o</sup> Celsius to observe growth. To assess the capability of the Bi-Polar<sup>®</sup> unit in reducing contamination in ice makers, two sets of Brain Heart Infusion Agar petri-plates were plated with inoculum collected from an ice-maker surfaces at 24, 48, 72, 120 and 168 hours after the ice maker was turned on. The bacterial colonies were observed with a SZ40 stereoscope after 24 hours of incubation at 37°C. Prepared slides were stained with Gram for bacterial colonies and Lacto-Phenol Cotton Blue for fungi and observed with a Leica DM-750 microscope. For the control plates, the inoculum was taken from an ice machine without a Bi-Polar<sup>®</sup> unit. A significant reduction in microbial entities including bacteria, fungi, slime molds and cyanobacteria was observed after running the Bi-Polar<sup>®</sup> unit for 168 hours or more.



Fig. 2. Jon Bennert, Jeff Bennert, Nabarun Ghosh

Fig. 2. Personnel involved in developing the AHPCO and Plasma based air cleaning systems for the Air Oasis: Dr. Jeff Bennert, Dr. N. Ghosh and Jon Bennert used the NASA developed nanotechnology to device techniques to improve the indoor air quality by introducing a new generation filter-less air purifiers using AHPCO nanotechnology. Recently we developed a small but very powerful unit called Bi-Polar<sup>®</sup> unit that is being used to reduce the chances of contamination in the ice maker. In the present investigation the Bi-Polar<sup>®</sup> unit is being evaluated in terms of reduction of surface microflora inside the ice maker.

## Bacteria and Fungi isolated from the ice-maker in use

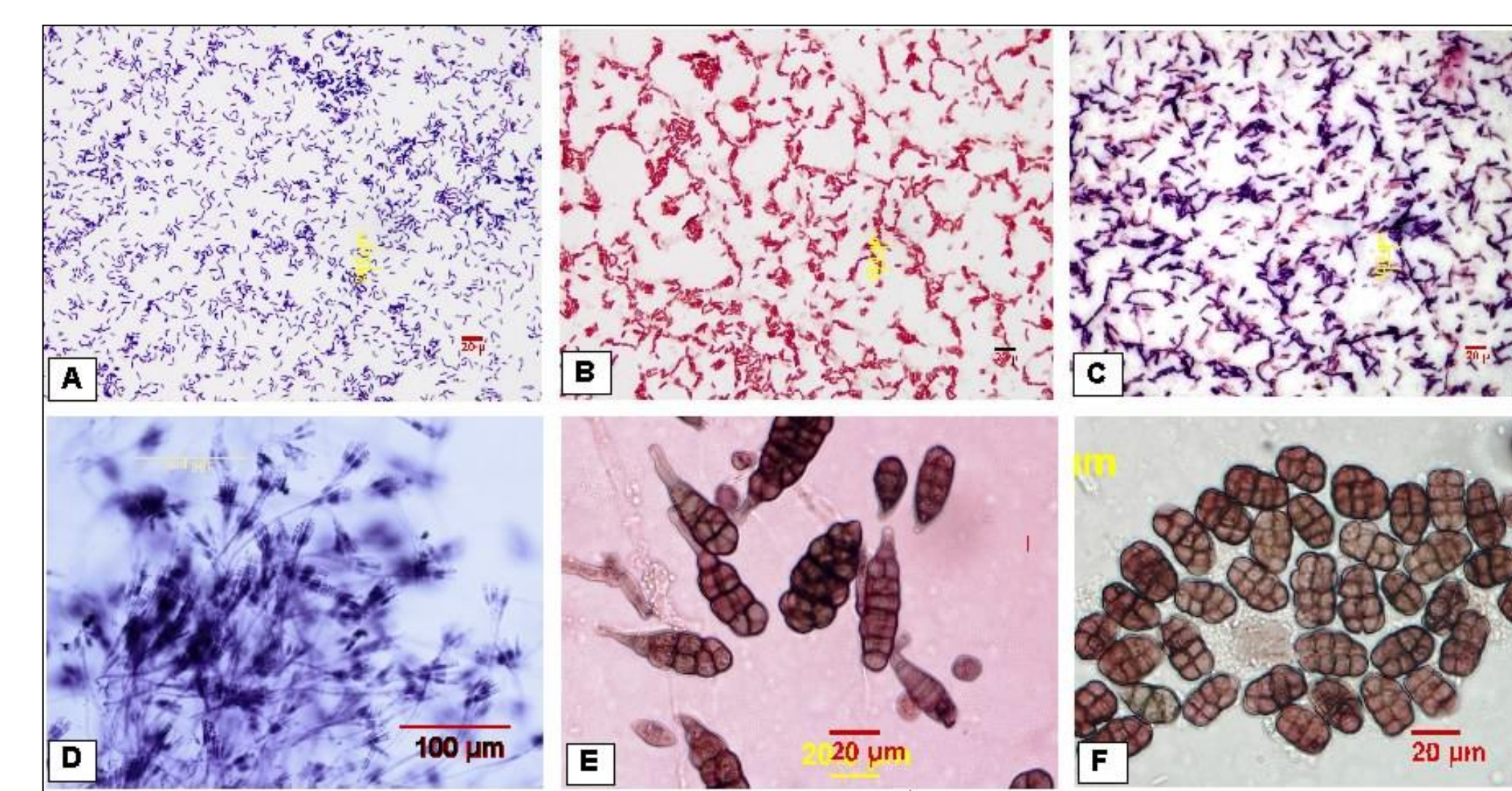


Fig.3A. showing the Gram positive *Bacilli* from the swab sample collected from the upper wall of the ice maker. B. Gram negative *Bacilli* from the ice maker floor. C. Swab cultures show spore-forming *Bacilli* collected from the floor surface of the ice maker. D. *Penicillium* sp. from swab from the wall of the ice maker. E. *Alternaria alternata* conidia and F. *Pithomyces* sp. spores collected from the swab from the corners. Swab-cultures from the set with no Bi-polar<sup>®</sup> unit running, incubated for 24 hr. at 37<sup>o</sup> C.

## Assessment using variable exposure to the Petri-plates



Fig.4. A-E showing petri-plates from swab cultures collected while running the Bi-polar<sup>®</sup> unit. Figs. A. the microbial colonies formed after running the unit for 24 h. B. 48h., C. 72h., D. 120h. and E. 168h. A gradual reduction in the number of microbial colonies were recorded from 72h., 120h. And 168h. A significant reduction in microbial entities including bacteria, fungi, slime molds and cyanobacteria was observed after running the Bi-Polar<sup>®</sup> unit for 168 hours or more.

We prepared slides from the microbial colonies from the petri-plates. The bacterial colonies were isolated from the fungal colonies by observing them under SZ-40 Stereo-microscope. The bacterial smears were stained with Gram Staining technique and the fungal colonies were stained using Lacto-Phenol Cotton Blue stain. The slides were observed and micro-graphs were captured using a Leica DM-750 microscope attached a digital camera and LAS V4.4 software (Fig. 3A-F).

## Result and Discussion

❖ We found that a significant reduction in the number of colonies formed per petri-plate with increased intervals while running the Bi-polar<sup>®</sup> unit (Fig.5) .

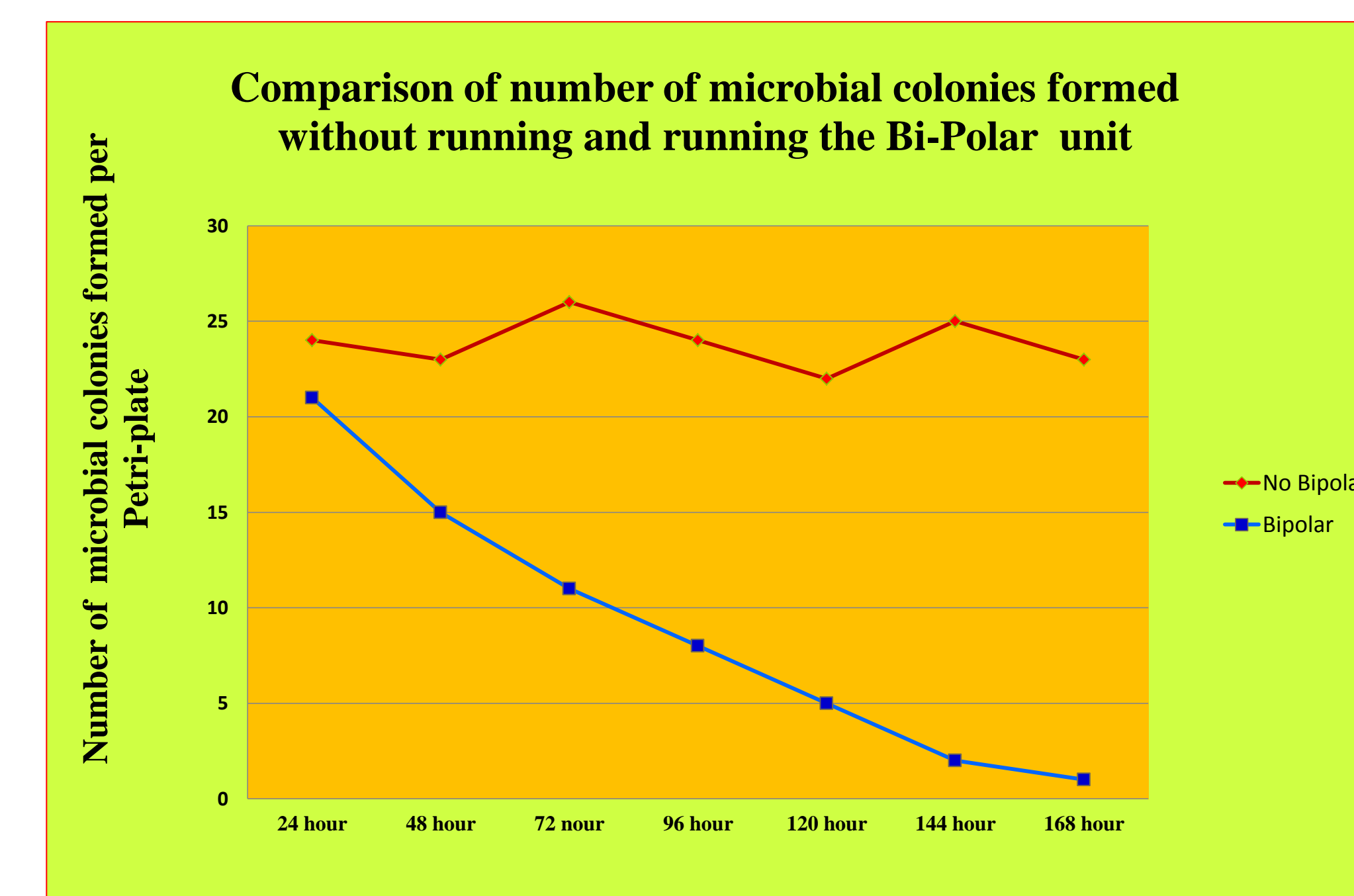


Fig. 5 the graph shows the significant correlation existed between the number of colonies formed with and without the Bi-polar<sup>®</sup> unit in course of time.

❖ Chances of contamination in the ice cubes reduced considerably on reduction of microbial population inside the ice-maker.

## Conclusion

Air Oasis<sup>1,2</sup> has successfully implemented the AHPCO and Plasma nanotechnology in building air purification system to reduce indoor aeroallergen to improve the Indoor Air Quality. Plasma nanotechnology has been used to prevent contamination in ice-makers and during food processing. After running the Bi-Polar<sup>®</sup> 168 hours or more, there was a significant reduction in microbial entities including bacteria, fungi, slime molds and Cyanobacteria. We also propose the usage of this novel Bi-Polar technology to prevent contamination during meat and other food processing on the conveyor belt. This technology, if used will prove to be an efficient way of reducing the food contaminants, especially during meat processing that toll thousands of lives in the world.

## References

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